

July 2015

Is Medical Thermography a Reliable Tool in Diagnosing Soft Tissue Injuries in Personal Injury Cases?

Gary L. Evans

Please take a moment to share how this work helps you [through this survey](#). Your feedback will be important as we plan further development of our repository.

Follow this and additional works at: <http://ideaexchange.uakron.edu/akronlawreview>



Part of the [Medical Jurisprudence Commons](#), and the [Torts Commons](#)

Recommended Citation

Evans, Gary L. (1988) "Is Medical Thermography a Reliable Tool in Diagnosing Soft Tissue Injuries in Personal Injury Cases?," *Akron Law Review*: Vol. 21 : Iss. 4 , Article 3.

Available at: <http://ideaexchange.uakron.edu/akronlawreview/vol21/iss4/3>

This Article is brought to you for free and open access by Akron Law Journals at IdeaExchange@UAkron, the institutional repository of The University of Akron in Akron, Ohio, USA. It has been accepted for inclusion in Akron Law Review by an authorized administrator of IdeaExchange@UAkron. For more information, please contact mjon@uakron.edu, uapress@uakron.edu.

IS MEDICAL THERMOGRAPHY A RELIABLE TOOL IN DIAGNOSING SOFT TISSUE INJURIES IN PERSONAL INJURY CASES?

by

GARY L. EVANS*

Medical thermography in personal injury cases has become an increasingly important issue and subject of debate in recent years. It is no longer unusual to find among a plaintiff's audit of special damages a thermographic report and bill. Due to its relative newness and significant cost it has generated controversy among its proponents and detractors.

Behind the mundane, albeit pressing and important questions as to whether and to what extent a thermographic exam changes the value of a case, there lurks a more basic issue; is thermography a legally and medically reliable tool in diagnosing soft tissue injuries? This article will examine that issue as it pertains to personal injury litigation and reach some qualified conclusions. Part I discusses thermography in general and describes electronic and liquid crystal thermography in particular. Part II divides reliability into two categories in an attempt to distinguish between medical and legal reliability. Part III discusses possible impacts caused by thermography usage in personal injury cases. Part IV addresses some problems accompanying that usage and poses possible solutions.

PART I

THERMOGRAPHY AND ITS HISTORY

Over 2,000 years ago Hippocrates layered mud over a sick friend's body. He noticed the mud dried and cracked quicker where inflammation of internal disease generated heat.¹ Hippocrates did not understand the physiological reasoning but was the first to appreciate the diagnostic significance of body temperature changes. Thermography developed as a science when it was used as a military tool to monitor troop movement at night. Its military, space and industrial applications continue.²

The body constantly emits invisible, infrared light. The wavelength of the emitted light is related directly to the temperature of the point on the body emitting it. By recording the infrared light emitted by the body, thermography accurately measures differential skin surface temperature. To graphically depict what is recorded, a photograph called a thermogram is taken. Thus, ther-

*J.D., University of Akron, School of Law, 1988.

¹Newman, *Infrared Imaging Thermography*, 13 LEGAL ASPECTS MED. PRAC. 1 (1985).

²Halbert, *Thermography: "Pictures" of Pain*, 7 PA. L.J. REP. 10 (1984).

mography is heat photography or a picture of heat.³ Because thermograms are heat pictures of the body surface, they are analogous to satellite weather maps used on T.V.⁴

Medical thermography has been used more than 25 years. As early as 1956 a report appeared on its use in breast tumors. In 1964 its use in orthopedics was outlined. In 1968 it was suggested that thermography may be either complementary or supplementary to myelography. A 1970 report on traumatic soft-tissue injuries noted that thermography offered the first objective method for clinical evaluation of musculoligamentous injuries by heat produced secondary to muscle spasm. It has proved useful in documenting many painful conditions⁵ known in the personal litigation field as soft-tissue injuries such as fascitis, hyperextension injury, hyperflexion injury, muscle tear, musculoligamentous spasm, myofascitis, nerve root irritation, neuralgia, sprain, strain, tendonitis, whiplash and of course malingering.⁶

Electronic Thermography

Thermography is based on the physiological principle that the infrared energy radiating from the skin surface varies, depending upon the amount of blood supply in and below the skin surface. Metabolism produces body heat which is distributed by the vascular and lymphatic systems to the overlying skin where radiation and convection expel that heat. When the blood supply to an area increases, as when blood vessels dilate and permit an increased flow of blood in and below an area, there is a quantitative increase in the overlying skin temperature which registers on the thermograms.⁷

Electronic Thermography (ET) uses an infrared camera which contains rotating mirrors and prisms cooled by liquid nitrogen. The camera senses the body image in brightly colored patterns over the entire visible surface and transmits them to a TV monitor. Slides are taken from the monitor while the patient is in certain positions in order to visualize all involved areas in a standard manner.⁸ ET involves no contact with the body and is totally non-invasive. Once the camera has measured the temperature variants, the thermographer interprets or makes symmetrical comparisons. He is looking for asymmetry. For example, the temperature in the right hand should be similar to that in the left hand. Temperature variance is seen through use of colors. Depending upon the technique used or the calibration of the camera, warm areas will show in yellows, oranges and reds or even browns while cooler areas will appear in

³Procida v. McLaughlin, 195 N.J. Super. 396, 479 A.2d 447 (1984).

⁴Pollum v. Borman's, Inc., 149 Mich. App. 57, 385 N.W.2d 724 (1986).

⁵Newman, *supra* note 1, at 2.

⁶Rein, *Thermography: Medical and Legal Implications*, 13 LEGAL ASPECTS MED. PRAC. 4 (1985).

⁷Archer and Zinn, *Thermograms: Persuasive Tools in Soft-Tissue Injury Cases*, 19 TRIAL 68 (1983).

⁸<http://ideaexchange.uakron.edu/akronlawreview/vol21/iss4/3>

⁸Uricchio, *Electronic Thermography in Medical Practice*, 13 LEGAL ASPECTS MED. PRAC. 1 (1985).

dark greens and blues. Because there can be a complete reversal of this color scheme in some instances, knowledge of the color code is imperative. Correlation between pain and color is represented by temperature comparison. Heat indicates inflammation, infection or injury. Generally, each different shade of color represents a one degree Centigrade temperature change.⁹

Liquid Crystal Thermography

With Liquid Crystal Thermography (LCT), a hermetically sealed box known as an air-pillow box is used to obtain temperatures of various parts of the body for diagnosis. One side of the box has a transparent plastic wall. The other side is composed of a rubber-like flexible sheath embedded with heat-sensitive liquid crystals which are a special compound of cholesterol derivatives. An air pump inflates the air-pillow box to conform to the contour of those parts of the body to be examined. Six or more boxes are available. They are progressively numbered 26 to 35 to correspond with the median Celsius temperature ranges of their liquid crystal sheaths.¹⁰

In an air conditioned, draft-free room, the skin temperature of that area of the body to be studied is stabilized by sponging with water approximately ten minutes. The technician selects the air-pillow box with the widest display for the patient's skin temperature. Liquid crystals have accurate and reliable color responses to specific temperature changes. Dark brown represents the lowest temperature and changes with progressive elevation to tan, reddish-brown, yellow, green, light blue and dark blue, the highest temperature. Initially, a 30° C. box is selected. If brown colors dominate, the skin is too cold for that particular box; a 28° C. box is then selected. If blue colors dominate, the skin is too warm and thus a 30° C. box should be used. The appropriate box is inflated and firmly pressed against the patient's body. On the liquid crystal a colored image appears almost immediately. To eliminate distortion and glare, the box is lifted slightly from the skin. An instant camera with an electronic flash system and a cross-polarized filter immediately photographs the image produced on the sheath.¹¹

A normal or negative thermogram shows symmetrical heat emission. An abnormal or positive thermogram shows symmetrically increased heat production at myotomes (muscle segments) in the central zone or decreased heat production lateral to the midline along the cervical, thoracic and upper lumbar spine. Abnormalities on color thermograms objectively indicate some type of injury or lesion.¹²

⁹Burton, *Thermography: Friend, Foe or Foolishness*, 33 DEF. L.J. 499, 500 (1984).

¹⁰Fay v. Mincey, 454 So.2d 587, 589 n.2 (Fla. Dist. Ct. App. 1984).

¹¹*Id.*

Prior to use of the air-pillow box the affected body surface was blackened with a type of water-based spray paint. The liquid crystals were then applied with an aerosol applicator. Pictures of the treated surface were taken fifteen to twenty minutes later.¹³

Local and Reflex Phenomenon

Thermography detects two types of abnormalities. A local tissue phenomenon produces a pattern on the skin surface above it. A reflex phenomenon produces a specific anatomical pattern at a distance from the pathology site.

1. Local

Bruises and inflections of soft tissue cause an inflammatory response of the body with increased local heat which is imaged as an indefinite pattern directly over the area.¹⁴ Vasodilation of the involved area causes the increased local heat. The thermogram machine will show a warm spot in this area.¹⁵

2. Reflex

Cervical, thoracic and lumbar are the three basic types of studies. A lumbar thermogram includes views of the lumbar back, buttocks, thighs and feet. A thoracic examination is usually limited to the mid-back. The cervical examination includes multiple views of the neck, shoulders, arms and hands.¹⁶

Studies of the neck and lower back include an examination of the extremities due to the reflex phenomenon. Scientists have anatomically charted the body into strip patterns indicating where each nerve that emits from the spine supplies specific muscles and sensation. These are called myotome (muscle) and dermatome (nerve) patterns.

In addition to carrying motor and sensory fibers, nerves also carry fibers of the sympathetic nervous system. Sympathetic nerves supply blood vessels to control the amount of blood flow to a certain area. Irritation of the sympathetic nerve fibers in the spine produces heat pattern alterations nearby in the back and at a distance in the limbs. Thus, irritation of a nerve in the spinal canal causes muscle spasms and a consequent increased heat pattern at the same myotome in the lower back. This irritation also stimulates the sympathetic fibers carried by the nerve that runs from the lower back over the buttock and down into the leg causing the blood vessels to constrict. Thus, a cold pattern is pro-

¹³ *Id.*

¹⁴ Lichtor, *Thermography in the Courtroom: An Overview*, 52 INS. COUNSEL J. 171, 172 (1985).

¹⁵ *Procida*, 159 N.J. Super. at 400, 479 A.2d at 449.

¹⁶ *Halbert*, *supra* note 2, at 40. <http://akronlawreview/vol21/iss4/3>

duced along the dermatome running from the back down the buttock into the leg. The reflex phenomenon is significant because you can look at the pattern and see which muscle or nerve is involved.¹⁷

PART II

RELIABILITY

While it is often difficult to determine exactly where medical reliability ends and legal reliability begins, it may be beneficial to discuss them separately to gain a better understanding as to how they relate.

Medical Reliability

1. Objectivity and Soft Tissue Injuries

Thermography has been touted as the most informative objective test used to corroborate or rule out soft tissue injury in patients with subjective complaints. Clearcut findings of a myofascial response can often be demonstrated and the injury can be followed through improvement and gradual disappearance.¹⁸ Before thermography became available, physicians relied on the patient's history, pin prick and reflex tests, range of demonstrated motion and observation of muscle spasm in diagnosing soft tissue injuries. Now there is a method to graphically document pain from these injuries.

In a recent New Jersey case¹⁹ involving the reliability of thermography, Dr. Harry Rein testified as to its objectivity. Dr. Rein is licensed to practice both medicine and law in Florida. At that time he was Medical Director of Thermographic Medical Associates and has supervised clinics in Ohio, Florida and Alaska. He has written at least four texts on medico-legal subjects including thermography. He testified that a physician may use thermography to answer the question of whether or not there is nerve injury, whether or not there is soft tissue injury and whether or not there is a reason for pain. However, Dr. Rein did state the thermogram does not quantify these answers.

In a separate article²⁰ Dr. Rein pointed out that thermography does not depend on patient participation. Therefore, a patient would be unable to fake normal or abnormal thermograms. Without it, an entire case often rests on the subjective reports of pain which the patient makes concerning his soft tissue injury. The objectivity of thermography cuts both ways; not only may it confirm a diagnosis, it may also help weed out malingerers.

The fact that a patient serves as his own involuntary control also supports

¹⁷Lichter, *supra* note 14, at 172.

¹⁸Uricchio, *supra* note 8, at 2.

¹⁹See *Procida*, 195 N.J. Super. at 338-39, 479 A.2d at 448.

²⁰Rein, *supra* note 6, at 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 380, 381, 382, 383, 384, 385, 386, 387, 388, 389, 390, 391, 392, 393, 394, 395, 396, 397, 398, 399, 400, 401, 402, 403, 404, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 427, 428, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 443, 444, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454, 455, 456, 457, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 472, 473, 474, 475, 476, 477, 478, 479, 480, 481, 482, 483, 484, 485, 486, 487, 488, 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 526, 527, 528, 529, 530, 531, 532, 533, 534, 535, 536, 537, 538, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557, 558, 559, 560, 561, 562, 563, 564, 565, 566, 567, 568, 569, 570, 571, 572, 573, 574, 575, 576, 577, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636, 637, 638, 639, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 667, 668, 669, 670, 671, 672, 673, 674, 675, 676, 677, 678, 679, 680, 681, 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 695, 696, 697, 698, 699, 700, 701, 702, 703, 704, 705, 706, 707, 708, 709, 710, 711, 712, 713, 714, 715, 716, 717, 718, 719, 720, 721, 722, 723, 724, 725, 726, 727, 728, 729, 730, 731, 732, 733, 734, 735, 736, 737, 738, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 749, 750, 751, 752, 753, 754, 755, 756, 757, 758, 759, 760, 761, 762, 763, 764, 765, 766, 767, 768, 769, 770, 771, 772, 773, 774, 775, 776, 777, 778, 779, 780, 781, 782, 783, 784, 785, 786, 787, 788, 789, 790, 791, 792, 793, 794, 795, 796, 797, 798, 799, 800, 801, 802, 803, 804, 805, 806, 807, 808, 809, 810, 811, 812, 813, 814, 815, 816, 817, 818, 819, 820, 821, 822, 823, 824, 825, 826, 827, 828, 829, 830, 831, 832, 833, 834, 835, 836, 837, 838, 839, 840, 841, 842, 843, 844, 845, 846, 847, 848, 849, 850, 851, 852, 853, 854, 855, 856, 857, 858, 859, 860, 861, 862, 863, 864, 865, 866, 867, 868, 869, 870, 871, 872, 873, 874, 875, 876, 877, 878, 879, 880, 881, 882, 883, 884, 885, 886, 887, 888, 889, 890, 891, 892, 893, 894, 895, 896, 897, 898, 899, 900, 901, 902, 903, 904, 905, 906, 907, 908, 909, 910, 911, 912, 913, 914, 915, 916, 917, 918, 919, 920, 921, 922, 923, 924, 925, 926, 927, 928, 929, 930, 931, 932, 933, 934, 935, 936, 937, 938, 939, 940, 941, 942, 943, 944, 945, 946, 947, 948, 949, 950, 951, 952, 953, 954, 955, 956, 957, 958, 959, 960, 961, 962, 963, 964, 965, 966, 967, 968, 969, 970, 971, 972, 973, 974, 975, 976, 977, 978, 979, 980, 981, 982, 983, 984, 985, 986, 987, 988, 989, 990, 991, 992, 993, 994, 995, 996, 997, 998, 999, 1000.

the objectivity of thermography. This is because abnormality is diagnosed where right-left temperature patterns are asymmetrical, with one side either abnormally hot or cold. Abnormality is generally defined as 0.6-1° C. temperature difference affecting 25% of the comparable surface areas of the same patient. The right-left patterns pertain to comparisons within one patient only and have nothing to do with comparing him to other patients. "All authorities agree that the infrared energy radiating from the skin will vary and is dependent on sub-surface circulation, which is under *involuntary* control of the sympathetic autonomic nervous system."²¹

2. Diagnostic Accuracy and Analogous Relationships

In recent years the reliability of diagnostic thermography has increased dramatically. This is probably due to significant increases in the sensitivity and reliability of the hardware as well as an ever-growing availability to the medical community. In a 1978 study, thermograms of previously unoperated patients revealed disc disease or nerve root irritation with 85 to 90 percent accuracy. Subsequent myelogram diagnosis of the same patients had the same accuracy where compared to post-surgical diagnoses. There have also been reported instances of positive thermographic diagnoses of internal disc derangements without herniation where there previously had been negative myelogram and electromyogram results.²²

As of February 1983 "the current view of the correlation of thermographic diagnoses and myelographic diagnoses appears to be that if the thermogram is positive the probability of a normal lumbar myelogram is quite small. The reverse is not true, however, and the myelographic results cannot be predicted from a negative thermogram result."²³

Dr. Michael Rask, M.D., an orthopedic surgeon and past president of the American Academy of Neurological and Orthopedic Surgeons, conducted a study of 150 patients with low back pain and sciatica. Of those 150 patients, thermography found 18 asymptomatic damaged disks. This study compared thermographic results with the results obtained through myelography. Dr. Rask drew some of the following conclusions:

- (1) As a diagnostic tool thermography is more accurate than myelography.
- (2) Thermography accurately diagnosed disk related problems in 148 out of 150 patients, while myelography was accurate in only 16 of 58 cases.
- (3) The defense bar and management should consider using thermography as a positive tool to rule out injuries, mitigate chronic complaints, and pro-

²¹ Newman, *supra* note 1, at 3.

²² Archer and Zinn, *supra* note 7, at 69.

Spring, 1988]

mote fair and reasonable settlements short of litigation.²⁴

Many physicians consider Dr. Charles E. Wexler, an Encino, California radiologist, the prime mover behind recent thermographic research and application. Dr. Wexler used 6,000 case studies in documenting for the first time that thermography can detect sensory nerve damage. Sensory nerves near the skin surface enable the sense of touch, while motor nerves operate muscles that enable movement. Dr. Wexler found that while clinically accepted electromyograms (EMG), myelograms and discograms can detect motor nerve and disk damage, they cannot verify sensory nerve damage which is usually associated with soft tissue injuries.²⁵ In another study of 86 patients Dr. Wexler compared physical findings and reported that thermography of the spine and extremities was 92 percent accurate, while EMG was only 83% accurate. He said studies by other physicians are producing accuracy rates approaching 99 percent.²⁶

3. Elimination of Artifacts

The problem of artifacts is minimal because a pathological thermal image will be reproducible over time.

A trained observer can identify, interpret, and eliminate artifactual patterns that may have a number of causes, including apparel, especially jewelry, brassieres, and waistbands; cosmetics, such as eye shadow, rouge, or balms; intrapersonal factors, such as hair, birthmarks, scars, perspiration, abrasions, and varicosities; environmental factors, such as those caused by reflecting walls, drafting, air vents, or cold floors; diagnostic procedures, such as electromyography or injections; therapeutic procedures, such as nerve blocks, cervical collars, transcutaneous nerve stimulation pads, gels, and adhesives; self-induced phenomena, resulting from pinching, scratching, rubbing, leg crossing, or hand holding; nutritional factors, such as ingestion of coffee or other hot and cold liquids or smoking; and technical factors relating to position, focus, dial settings, or the appropriate temperature for the LCT pillow.²⁷

If an unusual thermographic change cannot be easily explained on a clinical basis, or if a change does not persist during three sets of films, the test is negated and the patient must return for retesting. Even if a patient were to pinch, rub, or slap himself, the skin change would dissipate within a few minutes. Since a proper study consists of three repetitive studies separated by twenty minute intervals, it is highly unlikely that a patient would be able to consistently pro-

²⁴ Burton, *supra* note 9, at 502.

²⁵ Granelli, *Pictures of Pain Pay Off*, NAT'L L.J., September 27, 1982 at 22.

²⁶ Newman, *supra* note 1, at 2.

²⁷ *Id.*

duce an artifact in exactly the same dermatomic distribution on three separate occasions. It is important to remember that a significant thermographic interpretation depends on consistency of the findings with time over all three studies.²⁸

Dr. Wexler, a recognized thermographic expert, has said that those who put ice packs or heat sources on their bodies cannot repeat the procedure accurately enough to show the same patterns on subsequent pictures. He has never seen a false negative thermogram. "Anytime you want to check a thermogram, just repeat it. If a person's injured, it will show up the same way consistently."²⁹

4. Standards in Medical Community

Daniel Burton is a senior partner in a large Tampa, Florida law firm. Although his practice is devoted primarily to defense litigation, he warns that we should not be deceived by those who dismiss thermography, its results and its intrusion into the court system as a tool resorted to by the unqualified. Orthopedic surgeons, neurosurgeons, osteopathic physicians, radiologists and general practitioners recognize, administer, utilize, interpret and testify to thermography. There will inevitably be those who are more competent than others. Some will practice in hospitals and some in "thermography mills." Many experts in both the medical and legal communities feel that thermography is relatively useless in proving pain or soft tissue injury. One should be attentive to the premise from which the argument flows in that the general conclusions can resolve from either a dislike for the procedure, an unawareness of its existence, or an assertion that the test is premature and proves nothing.³⁰

As of April 1984 there were several thermographic associations, including the American Thermographic Association, the International Thermographic Society and the National Board of Thermography. Many medical schools including Johns Hopkins, Georgetown, George Washington University, University of Oklahoma, State University of New York, Wayne State University at the Harper Grace Hospitals and the University of Michigan at the Upjohn Pain Clinic teach thermography.³¹

DATTA, the American Medical Association's (AMA) technology assessment project, reported in May 1983 that thermography is still considered investigational in screening for the diagnoses of certain low back conditions. "Investigational" means the safety of the technique is established and the efficacy is being confirmed by research. Most medical procedures are initially considered investigational to allow new technologies to develop.³²

²⁸Uricchio, *supra* note 8, at 2. See also *Procida*, 195 N.J. Super. at 399, 479 A.2d at 449.

²⁹Granelli, *supra* note 25, at 22.

³⁰Burton, *supra* note 9, at 502.

³¹See *Procida*, 195 N.J. Super. at 403, 479 A.2d at 450-51. See also *Pollum*, 147 Mich. App. at 54, 385 N.W.2d at 725.

³²Newman *supra* note 1, at 3.

The American Academy of Thermology (AAT) formally protested with the AMA. The AAT rebutted that the DATTA study was deficient in survey design and lacked authoritative experts in that none of the participants practiced thermography. It also argued that the Director of the Bureau of Health Insurance of the U.S. Department of Health, Education and Welfare had accepted thermology for eleven years. The Bureau of Medical Devices of the U.S. Food and Drug Administration also accepted the procedure and noted thermography can be a useful adjunct for the diagnosis of musculoskeletal injuries. The AAT also pointed to the fact that 50% of the AMA panelists had no opinion. The AAT also felt the DATTA project did not follow established scientific protocols. The studies do contain a specific legal disclaimer: "not to be construed as an in-depth study, nor make any recommendation as to reimbursement."³³

Legal Reliability

1. Indicators of Evidential Reliability

In *United States v. Williams*,³⁴ the court of appeals addressed whether it was error to admit spectrographic voice analysis as identification evidence. The court stated there is no clearly defined, universal, litmus test for the general admissibility of all scientific evidence. In deciding to admit spectrographic voice analysis into evidence, the court said a determination of reliability cannot rest entirely on a process of counting scientific noses. Unanimity of opinion on any scientific question is extremely rare. A strong majority is only slightly less rare. It is also true that a court would find unreliable a technique without any support or only minuscule support in the scientific community. A technique, however, need not be infallible.

Recognizing that the main consideration upon which admissibility would be based was the reliability of the technique, the *Williams* court outlined four principal indicators of evidential reliability:

- (1) potential rate of error;
- (2) existence and maintenance of standards;
- (3) care and concern with which a scientific technique has been employed, and whether it appears to lend itself to abuse;
- (4) analogous relationship with other types of scientific techniques and their results, routinely admitted into evidence.

a. Potential Rate of Error

The potential rate of error as it relates to thermography has already been discussed in some detail above under the heading "Diagnostic Accuracy and

³³ *Id.*

³⁴ 583 F.2d 4194 (2d Cir. 1978), cert. denied, 439 U.S. 1117 (1979).

Analogous Relationships." I refer specifically to the 1978 study indicating 85 to 90 percent accuracy, Dr. Rask's study, and Dr. Wexler's studies.

Opponents of thermography are quick to point out that thermographic interpretation alone is not a diagnosis and that it shows only normal or abnormal heat patterns which may arise from congenital variation and physiological reasons.³⁵ However, its proponents also recognize it is better to use thermographic diagnostic tests in conjunction with the patient's history and other diagnostic tests such as EMG, myelography and CT scans to arrive at a diagnosis. Dr. Rein, a recognized expert, has found that a combination of EMG and thermography tests will yield a diagnostic accuracy of 90-94 percent. He pointed out that a practitioner understanding thermography will interpret a thermogram the same as any other practitioner.³⁶

b. Existence and Maintenance of Standards

Much of what was said above under the heading "Standards in Medical Community" pertains here to the existence and maintenance of standards.

In a March 1986 case³⁷ addressing whether thermographic evidence should be admissible, the defense contended the American Medical Association (AMA) still considers thermography investigational and not yet established. The court examined the March 1983 AMA article and concluded the AMA merely indicated it will conduct additional investigative research before issuing any further opinions on it.

To determine the AMA's position, I inquired at their main office in Chicago. Their Council on Scientific Affairs has set up a panel on the subject. The report will be entitled "Report of The Thermography Panel" and will consist of approximately twenty pages. It is possible the Council on Scientific Affairs will disapprove the panel's report.

Opponents of thermography often argue there are no set standards from the medical community regarding its technique and interpretation. However, the American Academy of Thermology began certification exams in March 1984.³⁸

c. Rate Employed and Abuse

There apparently are no hard figures as to what percentage of soft tissue injuries were or are diagnosed through thermography. The readings do indicate its usage has increased rapidly in the past five or six years. The care and con-

³⁵ See Lichtor, *supra* note 14, at 174.

³⁶ See *Procida*, 195 N.J. Super. at 400-01, 479 A.2d at 449.

³⁷ See *Burkett v. Northern*, 43 Wash. App. 143, 715 P.2d 1159 (1986).

cern with which the technique has been employed is an even more nebulous area. Certainly thermography can be abused and already has been in some instances. As previously noted, there inevitably will be those who are more competent than others, and some will practice in hospitals and some in "thermography mills."

d. Analogous Relationships

From an evidentiary perspective, one can compare thermograms to several other scientific techniques to objectify factual issues. For example, spectrography and polygraphy have been used to produce admissible evidence in many jurisdictions.³⁹

Spectrography is identification through voice analysis. In *United States v. Williams*,⁴⁰ the defense argued that admitting spectrographic data would mislead the jury due to its complicated, technical nature. The court disagreed and found that the critical step, visual pattern-matching, is easily understood by the jury. The same could be said regarding a jury's ability to comprehend and evaluate the color-coded temperature variations of thermograms.

The polygraph or lie detector records changes in blood pressure, respiration, pulse and galvanic skin response while the subject is questioned. A graphic chart records these variations and an examiner interprets them to determine the subject's truthfulness. One could argue that polygraphs are less reliable than thermograms since polygraphs are more susceptible to external factors such as the examiner's skill, the questions asked, variation in individual blood pressure, and how accustomed the subjects are to lying. Jurors strongly tend to accept polygraphic conclusions as uncontroverted fact though the accuracy rate is far from perfect. Despite its questionable reliability, several courts have admitted the test results into evidence.⁴¹

It is true that an individual can artificially create thermographic heat patterns in a variety of ways. However, a controlled testing environment can almost entirely eliminate external influences. Comparing thermographic technique to the acceptable techniques of polygraphy and spectrography suggests that thermograms are as reliable and as easily interpreted by jurors and should be equally admissible evidence.⁴²

2. Plaintiff Approach Is Balancing Test

Where the admissibility of thermography has been challenged and the plaintiff has prevailed on the issue, he has generally succeeded on a balancing test

³⁹ Dombroff, *The Reliability of Thermograms*, NAT'L L.J., December 19, 1983 at 15.

⁴⁰ See 583 F.2d 1194 (2d Cir. 1978), cert. denied, 439 U.S. 1117 (1979).

⁴¹ Dombroff, *supra* note 39, at 18.

approach. The two balancing tests most often mentioned are the *Williams* test and the Federal Rules of Evidence (FRE) test.

The *Williams*' court⁴³ stated that in cases dealing with admissibility of a particular type of scientific evidence, established considerations applicable to admissibility of evidence come into play, and probativeness, materiality, and reliability of evidence, on the one side, and any tendency to mislead, prejudice, or confuse the jury on the other, are the focal points of inquiry. This court determined reliability of the technique was the main consideration on which to base admissibility. It then discussed the evidential reliability indicators mentioned above in the immediately preceding section.

The FRE test is very similar to that announced by the *Williams*' court. It is based on the Federal Rules of Evidence 401,⁴⁴ 403⁴⁵ and 702⁴⁶ and the states' rules modeled after them. At least twenty states have enacted similar rules. The FRE test is a three-step process:⁴⁷

- (1) Determine the probative value of the new technique.
- (2) Assess potential dangers such as lack of reliability or misleading the jury.
- (3) Weigh the probative value and dangers. If probative value outweighs the danger, the evidence will be admitted.

In soft tissue injury cases the probative value of a thermogram is apparent because the methods of proof currently in use are highly subjective, primarily testimony of the injured party and physicians. Because it is said to be the only reliable, objective method of proving or disproving soft tissue injury and measuring the severity of the injury, thermography should be considered highly probative evidence. Arguably, the dangers of presenting a thermogram in court are minimal when weighed against its probative value. Its proponents maintain the technique is relatively straight-forward, well-tested and capable of jury interpretation.⁴⁸

*Procida v. McLaughlin*⁴⁹ was the first reported case in New Jersey admitting thermograms into evidence. Plaintiff Procida sought to present thermograms at a damages trial arising from an automobile accident. The court held that the thermogram is a diagnostic tool with a sufficient scientific basis to pro-

⁴³United States v. Williams, 583 F.2d 1194, 1198 (2d Cir. 1978), cert. denied, 439 US. 1117 (1979).

⁴⁴FED. R. EVID. 401. Relevant evidence means evidence having any tendency to make the existence of any fact that is of consequence to the determination of the action more probable or less probable than it would be without the evidence.

⁴⁵FED. R. EVID. 403. Although relevant, evidence may be excluded if its probative value is substantially outweighed by the danger of unfair prejudice, confusion of the issues, or misleading the jury, or by considerations of undue delay, waste of time, or needless presentation of cumulative evidence.

⁴⁶FED. R. EVID. 702. If scientific, technical, or other specialized knowledge will assist the trier of fact to understand the evidence or to determine a fact in issue, a witness qualified as an expert by knowledge, skill, experience, training, or education, may testify thereto in the form of an opinion or otherwise.

⁴⁷Archer and Zinn, *supra* note 7, at 71.

⁴⁸Dombroff, *supra* note 39, at 18.

⁴⁹195 N.J. Super. 396, 479 A.2d 447 (1984).

duce uniform and reasonably reliable results which would aid a jury in determining whether plaintiff had a soft tissue injury and that any dispute as to results and interpretation of testing would go to weight of thermography evidence rather than to its admissibility. Neither the *Williams* nor FRE tests were mentioned by name but it seems clear their substance was present. For example, the following statement made by the court seems to derive from FRE 401: "Scientific evidence is admissible if the proposed technique has sufficient scientific basis to produce uniform and reasonably reliable results and will contribute materially to the ascertainment of the truth."⁵⁰ Also, the following statement derives from FRE 403 and 702: "Application of the Rule entails a weighing of reliability against prejudice in light of the context in which the evidence is offered. Where expert testimony is sufficiently reliable to assist the jury, it should be admitted despite some countervailing dangers."⁵¹

Dr. Harry Rein who is licensed to practice both medicine and law in Florida testified in the *Procida* case. In March 1985 he felt that the FRE and the *Williams* tests reflect a significant trend in the admission of thermograms. He noted that thermograms have been admitted into evidence in personal injury cases in twelve states as well as into workers' compensation and arbitration cases.⁵²

3. Defense Approach Is Frye Test

Where the admissibility of thermography has been challenged and the defendant has prevailed on the issue, he has generally succeeded based on the *Frye* test. In *Frye v. United States*, the court held that "while courts will go a long way in admitting expert testimony deduced from a well-recognized scientific principle or discovery, the thing from which the deduction is made must be sufficiently established to have gained general acceptance in the particular field in which it belongs."⁵³ The *Frye* court also said it is difficult to define just when a scientific principle or discovery crosses the line between experimental and demonstrable stages.

Although several jurisdictions have abandoned this test, it is still the majority view. Acceptance of thermograms into evidence in the near future is doubtful in those jurisdictions adhering to the *Frye* standard. Even though a strong argument can be made for admitting thermograms in soft tissue injury cases, any attempt to do so will be difficult until there has been greater acceptance by the scientific and medical communities.⁵⁴

⁵⁰ *Id.* at 402, 479 A.2d at 450.

⁵¹ *Id.*

⁵² Rein, *supra* note 6, at 6.

⁵³ *Frye v. United States*, 293 F. 1013 (D.C. Cir. 1923). Defendant-Appellant Frye had been convicted of second degree murder. Frye attempted but failed to admit into evidence a systolic blood pressure deception test.

⁵⁴ Dombroff, *supra* note 39, at 21.

*Ferlise v. Eiler*⁵⁵ is the current law in New Jersey regarding the admissibility of thermograms. This too was a personal injury case arising from an auto accident. On appeal the defense contended that plaintiffs failed to present competent evidence that thermograms have achieved general acceptance in the medical community as a reasonably reliable diagnostic tool. The court held that plaintiff did fail to log the requisite foundation as to reliability of thermography in general and the thermograms performed here in particular for the test results to have been admitted. In so holding, this court distinguished this case from *Procida*⁵⁶ by stating the *Procida* court allowed the thermogram results in evidence only after a lengthy hearing at which experts testified as to the construction of and operational reliability of the thermographic machine, the need for careful control during operation and the necessity to give pre-operative instructions to the patient.

Despite the *Ferlise* court's attempts to distinguish the two cases, it effectively overruled *Procida*'s balancing test in favor of a "sufficiently reliable" test which may be demonstrated in any one of three ways:

- (1) expert testimony as to the general acceptance of the premise among those in the profession;
- (2) authoritative scientific and legal writing indicating that the premise enjoys general acceptance in the professional community; and
- (3) judicial opinions indicating the expert's premise has gained general acceptance.

While the court did not mention the *Frye* test by name, it is readily apparent it is the *Frye* test in substance if not in form.

*Burkett v. Northern*⁵⁷ is the most recent reported case in the U.S. regarding the admissibility of thermograms. Plaintiff sought damages for soft tissue injuries sustained in an auto accident. On appeal the defense contended that expert testimony regarding thermography should have been excluded as it is not reliable nor generally accepted in the medical field. The court held the record did not establish that thermographic evidence was sufficiently reliable or accepted in the medical community to be admitted. Eight years earlier the court had adopted the *Frye* test as the standard for admitting testimony based on scientific experimental procedures.⁵⁸ In the instant case, the only evidence tending to support or show the reliability and general acceptance of thermography in the scientific community was the testimony of the same physician who had given the plaintiff thermographic tests.

Dr. Harry Rein's statement in March 1985 that he felt the *FRE* and *Williams*

⁵⁵ 202 N.J. Super. 330, 495 A.2d 129 (1985).

⁵⁶ See *Procida v. McLaughlin*, 195 N.J. Super. 396, 479 A.2d 447 (1984).

⁵⁷ 43 Wash. App. 143, 715 P.2d 1159 (1986).

⁵⁸ See *State v. Canada*, 90 Wash.2d 808, 585 P.2d 1185 (1978).

test reflect a significant trend⁵⁹ may have been premature. In July 1985 *Ferlise v. Eiler* effectively overruled *Procida v. McLaughlin* and substituted a test substantially similar to the *Frye* standard in place of a balancing test. In March 1986 *Burkett v. Northern*, the most recent reported case in the U.S., held the *Frye* test will govern the admissibility of thermograms.

If a court should reject the *Frye* test and admit thermograms into evidence based on a balancing test, the defense might succeed using an argument based on Federal Rule of Evidence 403. The defense could argue that the sharply divergent colors on the thermogram photograph would mislead the jurors. For instance, a pink area next to a blue area may represent only a one degree temperature difference, yet the contrast is dramatic.⁶⁰ Although the temperature differences may not relate to a claimed injury, the defense might have an unduly burdensome task in overcoming this prejudice.⁶¹

PART III

IMPACTS OF USAGE

Over v. Underdiagnosis

On the rare occasions when the difference in heat emissions between the right and left sides of a thermogram is minor and does not meet strict criteria, the physician must decide whether it is better to overdiagnose or underdiagnose. He must decide whether too much diagnoses (the liberal attitude) is a danger to the patient or whether too little diagnoses (the conservative approach) is an equal or even bigger danger to the patient. The borderline cases present questions of interpretation. If a choice must be made, who gets the benefit of a doubt? If there is litigation, who gets the benefit of a sympathetic interpretation?⁶²

If overdiagnosis does not lead to surgery, excessive expense, fear or prolonged physical or mental disability, it poses little risk to the patient. However, this can be a real danger when a physician overdiagnoses and a lawyer continues getting additional consultations and referrals, and either or both of them encourage the patient to undergo more and more treatment. This can cause a patient to consciously or subconsciously believe that something must be very wrong; otherwise, there would be less concern, testing, and treatment.⁶³

Because underdiagnosis can cause one with genuine pain and other symptoms to be viewed as exaggerating or malingering, it is also risky. The thought that "no one believes me" can produce emotional debility. Also, the symptoms go unrelieved. If the diagnosis is inadequate, a surgically treatable condi-

⁵⁹ See Rein, *supra* note 6, at 6.

⁶⁰ See Granelli, *supra* note 25, at 22.

⁶¹ Lichter, *supra* note 14, at 177.

⁶² See Rein, *supra* note 6, at 5.

⁶³ *Id.*

tion may go uncorrected.⁶⁴

As a Settlement Tool

Thermography may eventually be an incentive to encourage defendants to settle, particularly in soft tissue cases without other objective findings.

At least one California lawyer⁶⁵ feels that positive thermograms can be used to place the defendant's insurance carrier in a potential bad faith situation in soft tissue injury cases. He drew the following incredible scenario: Defendant rear-ends client stopped for traffic. Previously asymptomatic client has immediate neck and shoulder complaints. X-rays of the spine are read as negative. He loses no work and receives no further medical care. Fifteen months later, thermograms indicate a cold spot left of the third thoracic vertebra, and intense heat activity over the posterior triangle of both sides of the neck. The study is interpreted as early degenerative changes at C5-C6.

The total of all medical bills including thermography is under \$400. Yet, the thermogram results have placed the insurance carrier in a policy limits demand situation. Under California law, the carrier, by not tendering the policy limit, could expose itself to risking an excess judgment. Although the plaintiff received no medical treatment beyond the emergency room, the case is settled for the full policy limit.⁶⁶

On the other hand, thermography is a double-edged sword; it can confirm a diagnosis or weed out malingerers. Negative thermogram results should diminish the value of a soft tissue injury case by exposing the fraud or malingerer. However, I have found no cases to date where the defense has used thermography to its benefit. Philadelphia attorney Samuel D. Hodge Jr., a leading expert in the field, mistakenly thought thermography would become a defense tool.⁶⁷ Should the defense decide to use the technique, plaintiff attorneys will find it tough to object to demands that their clients undergo testing because unlike EMGs, myelograms or discograms, thermograms require no pins, needles, or other invasive techniques.⁶⁸

PART IV

PROBLEMS AND SOLUTIONS

Abuse

The practice of thermography has extended beyond what is considered the usual parameters of accepted medical procedure. Opportunists have gone into

⁶⁴*Id.*

⁶⁵See Archer and Zinn, *supra* note 7, at 69.

⁶⁶*Id.*

⁶⁷Halbert, *supra* note 2, at 11.

⁶⁸See Grinnell, *supra* note 25, at 23.

the thermography business and almost immediately thereafter have held themselves out as experts. Some chiropractors have advertised themselves as thermographic experts available to testify on injury and pain. One midwestern chiropractor advertised an entire body thermogram for \$635, an examination without medical legitimacy.⁶⁹

A possible solution to dealing with the opportunists is more control in the form of standardization, regulation, and licensing. Some take the position that thermography requires both medical application and medical interpretation. It would then follow that chiropractic opinion has neither medical competence nor medical validity since chiropractic lacks medical legitimacy.⁷⁰

Another way to deal with opportunists is to recognize that no test by itself including thermography can be the basis for a diagnosis. Competent medical opinions derive from the diagnostic process. The orderly accumulation of facts obtained from history, present complaints, physical examination and other selected tests combined with the matching of these facts with known injury and disease patterns are all included in the process. Each item of information, including tests, can only be provisional, as each is only a part of the whole diagnostic process. A test result is useful only if substantiated by other facts, and if that result fits the clinical picture.⁷¹

The problem of abuse as it relates to artifacts was discussed above under the heading "Elimination of Artifacts." In addition to insisting on a proper study consisting of three repetitive studies separated by twenty minute intervals, the defense could insist that their representative be present during the tests. Not only should one analyze the thermographic results as to the validity, he should also examine how the thermograph itself was administered. Either upon deposition or in the courtroom, a voir dire of the technician or interpreter is an absolute must to determine whether the thermogram was performed under controlled conditions.⁷²

Insurance Costs

Thermography has tended to raise the cost of insurance claims just as have many other newly introduced diagnostic procedures. This is especially disturbing because insurance rates are already high and climbing. There are possible solutions other than continuing to raise rates and spread the cost among the insurance buying public.

Insurance companies could mitigate the rise in claim costs by paying for thermograms only as part of special damages and not considering them

⁶⁹ See Lichtor, *supra* note 14, at 176.

⁷⁰ *Id.*

⁷¹ *Id.* at 171.

Published by IdeaExchange@UAkron, 1988

⁷² See Burton, *supra* note 9, at 501.

again in evaluating general damages. This conservative approach would often work with cases settled by negotiations only. It would be effective because well over ninety percent of personal injury cases settle short of trial or mandatory arbitration.

Or, insurance companies could take a more aggressive approach by challenging the admission of thermography into evidence. This could be especially fruitful in those jurisdictions still adhering to the *Frye* standard. Among all the states, I found less than thirty reported cases even mentioning thermography. One has to conclude the admission of thermograms is not being challenged.

Another alternative is even more aggressive. If insurance companies feel the local plaintiff bar is abusing thermography, the companies could make all little fender-bender plaintiffs submit to thermograms. After all, the experts seem to agree there are no "false negatives."⁷³ Admittedly, this would be expensive short term but could be cost effective long term.

CONCLUSION

If a jurisdiction uses the *Frye* test, medical thermography will not be considered medically (and legally) reliable at this time. In all the reported cases using the *Frye* test or a substantially similar test, thermography was found not to have gained general acceptance in the medical community. Given its present low rate of usage and its vocal opposition, it seems very unlikely that thermography will meet this standard in the near future.

If a jurisdiction adopts a balancing test such as that based on the Federal Rules of Evidence or the *Williams* case, medical thermography would probably be admissible in that jurisdiction today. Among all the reported cases, I found only three jurisdictions admitting thermography into evidence.⁷⁴ However, in New Jersey, the balancing test may have been abandoned in favor of the *Frye* test.

There are also many jurisdictions such as Ohio where admitting thermography into evidence has not been an issue. This is because admitting thermography has not been challenged which explains why there are no reported cases. Excluding a few unusual common pleas decisions, the only cases reported in Ohio are those reaching the appellate level.

Ohio has not specifically adopted the *Frye* test⁷⁵ but there is good reason to believe it would follow that standard.⁷⁶ Possibly the defense bar and insurance companies fear making what they perceive as "bad law," especially in view

⁷³ See Granelli, *supra* note 25, at 22.

⁷⁴ See *Fay v. Mincey*, 454 So.2d 587 (Fla. Dist. Ct. App. 1984); *Deshotel v. Avondale Shipyards, Inc.*, 413 So.2d 208 (La. Ct. App. 1982); *Blanchard v. A-I Bit and Tool Co., Inc.*, 406 So.2d 773 (La. Ct. App. 1981); *Procida v. McLaughlin*, 195 N.J. Super. 396, 479 A.2d 447 (1984).

⁷⁵ See *State v. Williams*, 4 Ohio St.3d 53, 446 N.E.2d 444 (1983).

⁷⁶ See *State v. Olderman*, 44 Ohio App.2d 130, 336 N.E.2d 442 (1975).

of the state supreme court's recent record. Whatever the reason, the practice of admitting thermography into evidence without challenge seems likely to hasten the day that thermographic usage will become so widespread that it will eventually meet the *Frye* test and be considered legally reliable in all jurisdictions.

